

1 1. In a computer system that has access to interlaced representation of video, a
2 method of converting the interlaced representation of the video into a progressive
3 representation of the video by converting a first temporal field and a subsequent second
4 temporal field of interlaced video into a progressive frame so as to provide a high quality
5 progressive frame with relatively little processing resources even if there is motion
6 between the first temporal field and the second temporal field, the method comprising the
7 following:

8 an act of replicating one of the first temporal field or the second temporal
9 field to generate half of the progressive frame;

10 an act of estimating a correlation between a pixel of the other non-replicated
11 temporal field and at least one vertically adjacent pixel of the replicated temporal
12 field; and

13 an act of assigning a value to a subject pixel in the other half of the
14 progressive frame, the subject pixel corresponding to the position of the pixel of the
15 non-replicated temporal field, wherein the value is based on the correlation.

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17 2. A method in accordance with Claim 1, further comprising:

18 an act of repeating the act of estimating a correlation and the act of
19 assigning a value for each of the remaining pixels in the non-replicated temporal
20 field:

21
22 3. A method in accordance with Claim 1, wherein the act of assigning a value
23 to a subject pixel in the other half of the progressive frame comprises the following:

an act of assigning the value based on an interpolation between scan line interpolation and field merging depending on the correlation, wherein a higher correlation tends the value towards field merging and lower correlation tends the value towards scan line interpolation.

4. A method in accordance with Claim 1, wherein the act of assigning the value based on an interpolation between scan line interpolation and field merging comprises the following:

an act of determining a correlation value between zero and one inclusive that represents the correlation between the pixel of the non-replicated temporal field and the at least one vertically adjacent pixel of the replicated temporal field, wherein the act of assigning a value based on an interpolation comprises the following:

an act of multiplying the correlation value by the value that would be obtained by pure field merging; and

an act of multiplying one minus the correlation value by the value that would be obtained by pure scan line interpolation.

5. A method in accordance with Claim 4, wherein the act of multiplying one minus the correlation value by the value that would be obtained by pure scan line interpolation comprises the following:

an act of determining the value that would be obtained by pure scan line interpolation.

1 6. A method in accordance with Claim 5, wherein the act of determining the
2 value that would be obtained by pure scan line interpolation comprises the following:

3 an act of averaging the value of the upper pixel in the replicated field that is
4 immediately above the output position with the value of the lower pixel in the
5 replicated field that is immediately below the output position.

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7 7. A method in accordance with Claim 1, wherein the act of estimating a
8 correlation comprises the following:

9 an act of determining the correlation based on pixel values of field merged
10 representations of the first and second temporal fields in a vertical column that
11 includes the position of the subject pixel of the second temporal field.

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13 8. A method in accordance with Claim 7, wherein the vertical column is five
14 pixels in height, two pixels being above the subject pixel, and two pixels being below the
15 subject pixel.

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17 9. A method in accordance with Claim 7, wherein the vertical column in three
18 pixels in height, one pixel being above the subject pixel, and one pixel being below the
19 subject pixel.

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1 10. In a computer system that has access to interlaced representation of video, a
2 method of converting the interlaced representation of the video into a progressive
3 representation of the video by converting a first temporal field and a subsequent second
4 temporal field of interlaced video into a progressive frame so as to provide a high quality
5 progressive frame with relatively little processing resources even if there is motion
6 between the first temporal field and the second temporal field, the method comprising the
7 following:

8 an act of replicating one of the first temporal field or the second temporal
9 field to generate half of the progressive frame; and

10 a step for generating the other half of the progressive frame so that the value
11 of each pixel is adaptively determined on a per pixel basis depending on the vertical
12 correlation in the first and second temporal fields at the position of the pixel.

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14 11. A method in accordance with Claim 10, wherein the step for generating the
15 other half of the progressive frame comprises the following:

16 an act of estimating a correlation between a pixel of the other non-replicated
17 temporal field and at least one vertically adjacent pixel of the replicated temporal
18 field; and

19 an act of assigning a value to a subject pixel in the other half of the
20 progressive frame, the subject pixel corresponding to the position of the pixel of the
21 non-replicated temporal field, wherein the value is based on the correlation.
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12. A computer program product for use in a computer system that has access to interlaced representation of video, the computer program product for implementing a method of converting the interlaced representation of the video into a progressive representation of the video by converting a first temporal field and a subsequent second temporal field of interlaced video into a progressive frame so as to provide a high quality progressive frame with relatively little processing resources even if there is motion between the first temporal field and the second temporal field, the computer program product comprising a computer-readable medium having stored thereon computer-executable instructions which, when executed by one or more processors, cause the computer system to perform the following:

an act of replicating one of the first temporal field or the second temporal field to generate half of the progressive frame;

an act of estimating a correlation between a pixel of the other non-replicated temporal field and at least one vertically adjacent pixel of the replicated temporal field; and

an act of assigning a value to a subject pixel in the other half of the progressive frame, the subject pixel corresponding to the position of the pixel of the non-replicated temporal field, wherein the value is based on the correlation.

13. A computer program product in accordance with Claim 12, wherein the computer-readable medium is a physical storage medium.

14. A computer program product in accordance with Claim 12, wherein the computer-readable medium further has stored thereon computer-executable instructions

1 which, when executed by one or more processors, cause the computer system to
2 performing the following:

3 an act of repeating the act of estimating a correlation and the act of
4 assigning a value for each of the remaining pixels in the non-replicated temporal
5 field.

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7 15. A computer program product in accordance with Claim 12, wherein the
8 computer-executable instructions which, when executed by one or more processors, cause
9 the computer system to perform the act of assigning a value to a subject pixel in the other
10 half of the progressive frame comprise computer-executable instructions which, when
11 executed by one or more processors, cause the computer system to perform the following:

12 an act of assigning the value based on an interpolation between scan line
13 interpolation and field merging depending on the correlation, wherein a higher
14 correlation tends the value towards field merging and lower correlation tends the
15 value towards scan line interpolation.

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17 16. A computer program product in accordance with Claim 12, wherein the
18 computer-executable instructions which, when executed by one or more processors, cause
19 the computer system to perform the act of assigning the value based on an interpolation
20 between scan line interpolation and field merging comprises computer-executable
21 instructions which, when executed by one or more processors, cause the computer system
22 to perform the following:

23 an act of determining a correlation value that represents the correlation
24 between the pixel of the non-replicated temporal field and the at least one vertically

adjacent pixel of the replicated temporal field, wherein the act of assigning a value based on an interpolation comprises the following:

an act of multiplying the correlation value by the value that would be obtained by pure field merging; and

an act of multiplying one minus the correlation value by the value that would be obtained by pure scan line interpolation.

17. A computer program product in accordance with Claim 16, wherein the computer-executable instructions which, when executed by one or more processors, cause the computer system to perform the act of multiplying one minus the correlation value by the value that would be obtained by pure scan line interpolation comprise computer-executable instructions which, when executed by one or more processors, cause the computer system to perform the following:

an act of determining the value that would be obtained by pure scan line interpolation.

18. A computer program product in accordance with Claim 17, wherein the computer-executable instructions which, when executed by one or more processors, cause the computer system to perform the act of determining the value that would be obtained by pure scan line interpolation comprise computer-executable instructions which, when executed by one or more processors, cause the computer system to perform the following:

an act of averaging the value of the upper pixel in the replicated field that is immediately above the output position with the value of the lower pixel in the replicated field that is immediately below the output position.

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19. A computer program product in accordance with Claim 12, wherein the computer-executable instructions which, when executed by one or more processors, cause the computer system to perform the act of estimating a correlation comprise computer-executable instructions which, when executed by one or more processors, cause the computer system to perform the following:

an act of determining the correlation based on pixel values of field merged representations of the first and second temporal fields in a vertical column that includes the position of the subject pixel of the second temporal field.

1 20. In a computer system that has access to interlaced fields of video, a method
2 of converting three temporally adjacent input fields of interlaced video into two output
3 fields of interlaced video, the method comprising the following:

4 an act of replicating the second temporal input field to reproduce a first of
5 the output fields;

6 for a given output pixel corresponding to an output position of the second
7 output field, an act of using at least one pixel of the second temporal input field that
8 is vertically adjacent to the output position of the second output field to determine
9 which of the first temporal input field and third temporal input field more closely
10 correlates to the second temporal input field at the output position; and

11 an act of assigning a value to the output pixel based on the correlation
12 between the first temporal input field and the second temporal input field, and
13 between the third temporal input field and the second temporal input field
14 corresponding to the output position.
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16 21. A method in accordance with Claim 20, wherein the act of using at least one
17 pixel of the second temporal input field that is vertically adjacent to the output position of
18 the second output field to determine which of the first temporal input field and third
19 temporal input field more closely correlates to the second temporal input field at the output
20 position comprises the following:

21 an act of accessing an upper pixel of the second temporal input field which
22 is directly above the output position of the second output field;

23 an act of accessing a lower pixel of the second temporal input field that is
24 directly below the output position of the second output field;

1 an act of interpolating a value based on the values of the upper pixel and the
2 lower pixel; and

3 an act of using the interpolated value to determine which of the first
4 temporal input field and the third temporal input field more closely correlates to the
5 second temporal input field at the output position.

6
7 22. A method in accordance with Claim 21, wherein the act of interpolating a
8 value based on the values of the upper pixel and the lower pixel comprises the following:

9 an act of averaging the value of the upper pixel with the value of the lower
10 pixel to generated the interpolated value.

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12 23. A method in accordance with Claim 21, wherein the act of using the
13 interpolated value to determine which of the first temporal input field and the third
14 temporal input field more closely correlates to the second temporal input field comprises
15 the following:

16 an act of comparing the interpolated value to the value of the pixel in the
17 first temporal input field that correlates to the output position; and

18 an act of comparing the interpolated value to the value of the pixel in the
19 third temporal input field that correlates to the output position.

20
21 24. A method in accordance with Claim 21, wherein the act of assigning a value
22 to the output pixel based on the correlation between the first temporal input field and the
23 second temporal input field, and between the third temporal input field and the second
24 temporal input field corresponding to the output position comprises the following:

1 an act of tending the value of the output pixel more towards the value of the
2 pixel in whichever of the first temporal input field or third temporal input field at
3 the output position is closer to the interpolated value.
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5 25. A method in accordance with Claim 24, wherein the act of tending the value
6 of the output pixel comprises the following:

7 an act of keeping track of a blending factor that is used to determine how
8 much of the value of the pixel in the first temporal input field at the output position,
9 and how much of the value of the pixel in the third temporal input field at the
10 output position is weighed in assigning the value to the output pixel.
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12 26. A method in accordance with Claim 25, further comprising the following:

13 an act of changing the value of the blending factor in one direction if the
14 interpolated value is closer to the value of the pixel in the first temporal input field
15 at the output position;

16 an act of changing the value of the blending factor in the opposite direction
17 if the interpolated value is closer to the value of the pixel in the third temporal input
18 field at the output position; and

19 an act of using the changed blending factor when analyzing the next
20 horizontally adjacent output pixel.
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1 27. A computer program product for use in a computer system that has access
2 to interlaced fields of video, the computer program product for implementing a method of
3 converting three temporally adjacent input fields of interlaced video into two output fields
4 of interlaced video, the computer program product comprising a computer-readable
5 medium having stored thereon computer-executable instructions which, when executed by
6 one or more processors, cause the computer system to perform the following:

7 an act of replicating the second temporal input field to reproduce a first of
8 the output fields;

9 for a given output pixel corresponding to an output position of the second
10 output field, an act of using at least one pixel of the second temporal input field that
11 is vertically adjacent to the output position of the second output field to determine
12 which of the first temporal input field and third temporal input field more closely
13 correlates to the second temporal input field at the output position; and

14 an act of assigning a value to the output pixel based on the correlation
15 between the first temporal input field and the second temporal input field, and
16 between the third temporal input field and the second temporal input field
17 corresponding to the output position.

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19 28. A computer program product in accordance with Claim 27, wherein the
20 computer-executable instructions which, when executed by one or more processors, cause
21 the computer system to perform the act of using at least one pixel of the second temporal
22 input field that is vertically adjacent to the output position of the second output field to
23 determine which of the first temporal input field and third temporal input field more
24 closely correlates to the second temporal input field at the output position comprise

1 computer-executable instructions which, when executed by one or more processors, cause
2 the computer system to perform the following:

3 an act of accessing an upper pixel of the second temporal input field which
4 is directly above the output position of the second output field;

5 an act of accessing a lower pixel of the second temporal input field which is
6 directly below the output position of the second output field;

7 an act of interpolating a value based on the values of the upper pixel and the
8 lower pixel; and

9 an act of using the interpolated value to determine which of the first
10 temporal input field and the third temporal input field more closely correlates to the
11 second temporal input field at the output position.

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13 29. A computer program product in accordance with Claim 28, wherein the
14 computer-executable instructions which, when executed by one or more processors, cause
15 the computer system to perform the act of interpolating a value based on the values of the
16 upper pixel and the lower pixel comprise computer-executable instructions which, when
17 executed by one or more processors, cause the computer system to perform the following:

18 an act of averaging the value of the upper pixel with the value of the lower
19 pixel to generated the interpolated value.

20
21 30. A computer program product in accordance with Claim 28, wherein the
22 computer-executable instructions which, when executed by one or more processors, cause
23 the computer system to perform the act of using the interpolated value to determine which
24 of the first temporal input field and the third temporal input field more closely correlates to

1 the second temporal input field comprise computer-executable instructions which, when
2 executed by one or more processors, cause the computer system to perform the following:

3 an act of comparing the interpolated value to the value of the pixel in the
4 first temporal input field that correlates to the output position; and

5 an act of comparing the interpolated value to the value of the pixel in the
6 third temporal input field that correlates to the output position.

7
8 31. A computer program product in accordance with Claim 28, wherein the
9 computer-executable instructions which, when executed by one or more processors, cause
10 the computer system to perform the act of assigning a value to the output pixel based on
11 the correlation between the first temporal input field and the second temporal input field,
12 and between the third temporal input field and the second temporal input field
13 corresponding to the output position comprise computer-executable instructions which,
14 when executed by one or more processors, cause the computer system to perform the
15 following:

16 an act of tending the value of the output pixel more towards the value of the
17 pixel in whichever of the first temporal input field or third temporal input field at
18 the output position is closer to the interpolated value.

19
20 32. A computer program product in accordance with Claim 31, wherein the
21 computer-executable instructions which, when executed by one or more processors, cause
22 the computer system to perform the act of tending the value of the output pixel comprise
23 computer-executable instructions which, when executed by one or more processors, cause
24 the computer system to perform the following:

1 an act of keeping track of a blending factor that is used to determine how
2 much of the value of the pixel in the first temporal input field at the output position,
3 and how much of the value of the pixel in the third temporal input field at the
4 output position is weighed in assigning the value to the output pixel.

5
6 33. A computer program product in accordance with Claim 32, wherein the
7 computer-readable medium further has stored thereon computer-executable instructions
8 which, when executed by one or more processors, cause the computer system to perform
9 the following:

10 an act of changing the value of the blending factor in one direction if the
11 interpolated value is closer to the value of the pixel in the first temporal input field
12 at the output position;

13 an act of changing the value of the blending factor in the opposite direction
14 if the interpolated value is closer to the value of the pixel in the third temporal input
15 field at the output position; and

16 an act of using the changed blending factor when analyzing the next
17 horizontally adjacent output pixel.

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19 34. The computer program product in accordance with Claim 27, wherein the
20 computer-readable medium is a physical storage medium.
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1 35. In a computer system that has access to interlaced fields of video, a method
2 of converting three temporally adjacent input fields of interlaced video into two output
3 fields of interlaced video for improved processing of sudden difference video, the method
4 comprising the following:

5 an act of replicating the second temporal input field to reproduce a first of
6 the output fields; and

7 a step for generating the second output field pixel-by-pixel considering
8 similarities between temporal input fields.

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